Removal of astrazon red 6B from aqueous solution using waste tea and spent tea bag

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ABSTRACT
This study aimed to remove basic dye (astrazon red 6B (AR)) from liquid environment by adsorption. For this purpose, batch experiments were performed using spent tea leaves (TL) and tea bags (TB) as adsorbents due to their low costs. Adsorption experiments were carried out for different initial concentrations (25–200 mg/L), different pH values (pH 2–10), and different adsorbent amounts (0.25–2 g/L) of solution. Equilibrium sorption isotherms and kinetics were investigated. The experimental data were analyzed by the Langmuir, Freundlich and Temkin models of adsorption. The adsorption data fitted well to the Freundlich isotherm for TL and Langmuir isotherm for TB. Two kinetic models, pseudo-first order and pseudo-second order, were employed to describe the adsorption mechanism. According to the results of the analysis, the pseudo-second-order equation was determined to be the best model to describe the adsorption behavior for both adsorbents with the determination factor $R^2 \geq 0.92$. The results proved that the spent TL and used TB could be potentially used as low-cost adsorbents for the removal of AR from aqueous solutions.

Keywords: Adsorption; Astrazon red; Isotherm; Kinetics; Tea bag; Tea leaf